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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/780,390	02/12/2001	Howard E. Rhodes	M4065.0111/P111-A	9416
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DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP 2101 L STREET NW WASHINGTON, DC 20037-1526				
			EXAMINER	
			MALSAWMA, LALRINFAMKIM HMAR	
			ART UNIT	PAPER NUMBER
			2825	

DATE MAILED: 12/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/780,390

Applicant(s)

RHODES ET AL.

Examiner

Lex Malsawma

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 17 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-7 and 9-87 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7, 10-19, 24-35, 37-58, 60-75 and 77-87 is/are rejected.
- 7) ☒ Claim(s) 9, 20-23, 36, 59 and 76 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 April 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on November 17, 2003 has been entered.

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-7, 10-15, and 24-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant admitted prior art, hereinafter, "APA" (Fig. 1 and specification pages 2-3) in view of Chang (6,140,670).

#### ***Regarding Claims 1-4, and 10:***

APA discloses (in Fig. 1) a diode comprising:

an isolation region 20 formed in a substrate 10 by LOCOS or STI (page 3, lines 3-6);

a first doped active layer 30 comprising a first conductivity type (n-type) formed in said substrate;

a second doped active layer 12 of a second conductivity type (p-type) in contact with said first doped active layer 30, the contact of a said first and second active layers forming a p-n junction; and

a third doped region 40 (p-type) formed in said second doped active layer 12 beneath said isolation region.

APA **lacks** the first doped active layer 30 being spaced apart from said isolation region. Chang **teaches** that junction leakage current within a diode can be significantly reduced by spacing active region “210” apart from isolation regions “204” (note Fig. 2C and Col. 2, lines 24-30). Note that Chang’s active region “210” would be equivalent to APA’s active region “30”. It would have been obvious to one of ordinary skill in the art to modify APA as taught by Chang because such a modification could significantly improve device performance by reducing junction leakage current within the device.

*Regarding Claims 5-7:*

Chang lacks specifying any particular range for a space between the first doped region 210 and the isolation region 204; however, APA (in view of Chang) discloses the general conditions of the claimed invention. It would have been obvious to one of ordinary skill in the art to modify APA (in view of Chang) by specifying a range for said space (as in the instant claims), since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

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*Regarding Claims 11 and 12:*

It was very well known and common in the art to utilize phosphorous, arsenic, or antimony as an n-type dopant in the manufacture of semiconductor devices; therefore, it would have been an obvious matter of design choice for one of ordinary skill in the art to specifically utilize any one of the well-known n-type dopants.

*Regarding Claims 13 and 14:*

APA (in view of Chang) lacks specifying any particular dopant-dosage range for the first doped region, however, it is important to note that the general conditions of the claimed invention are disclosed. Therefore, it would have been obvious to one of ordinary skill in the art to specify a range for dopant dosage (as in the current claim) because APA (in view of Chang) discloses the general conditions of the claimed invention, and it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

*Regarding Claim 15:*

APA discloses the first doped active layer 30 is n-type and the second doped active layer 12 is a p-well.

*Regarding Claims 24-27:*

Chang discloses, “[i]n general, photodiode devices are used as imaging sensors in different types of equipment, for example, PC cameras and digital cameras” (note col. 1, lines 33-35). One of ordinary skill in the art would realize that such cameras would include a CCD imager array, a CMOS imager array, a memory array, and/or a logic array. Therefore, the instant claims are held obvious over APA (in view of Chang).

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4. Claims 16-19, and 28-35, 37-58, 60-75, and 77-87 are rejected under 35 U.S.C. 103(a) as being unpatentable over APA (in view of Chang) as applied to Claim 1 above, and further in view of Sasaki (6,150,676).

*Regarding Claims 16-19:*

APA (in view Chang) **lacks** a fourth doped active region at least partially within the first doped active layer. Sasaki **teaches** (in Figs. 11-14) that a photodiode can be formed having various structures, wherein a “fourth” doped active layer “63” is formed at least partially within a first doped active layer 53 (note Fig. 13, active layer “53” is n-type). Note in Fig. 13, Sasaki discloses a diode structure comprising a doped active layer 63 (n-type) within a first doped active layer 53 (n-type), wherein the doped active layer 63 is spaced away from the edge of the first active layer 53. Sasaki further discloses that the doped active layer 63 can have a dopant concentration in the range of  $1 \times 10^{12}$  to  $1 \times 10^{16} \text{ cm}^{-3}$ , wherein one of ordinary skill in the art would realize that such a range in dopant concentration could be readily obtained with a dopant dose of  $1 \times 10^{12}$  to  $1 \times 10^{16} \text{ ions/cm}^2$ , since the concentration would be a function of a dopant-dosage range and a depth of implantation. Sasaki **teaches** that device performance can be significantly improved when a photodiode incorporates such a structure (i.e., a “fourth” doped active layer 63 within a first doped active layer, note Col. 12, lines 7-10). Therefore, it would have been obvious to one of ordinary skill in the art to modify APA (in view of Chang) by incorporating a fourth doped active layer within said first doped active layer because Sasaki teaches such a structure would significantly improve device performance.

*Regarding Claim 28:*

This claim is similar to Claim 16; therefore, it is held obvious over the cited references with reasoning similar to that applied to Claims 1 and 16-19 above. Note that Sasaki discloses (in Fig. 13) the doped region "63" (i.e., the second doped active layer) is doped to a higher dopant dose than the first doped active layer "53"; and Sasaki discloses the first and second active layers (53, 63) and the substrate "62" form a p-n junction.

*Regarding Claims 29-31, 38-43, and 45:*

APA (in view of Chang and Sasaki) disclose, or render obvious, all limitations within these claims. Note that all limitations within these claims have been specifically addressed above.

*Regarding Claims 32-34:*

These claims are similar to Claims 5-7, which were addressed in detail above; therefore, these claims are held obvious over the cited references with reasoning similar to that applied to Claims 5-7 above.

*Regarding Claims 35, 37, 44, 58, 60, 64, 75, 77, and 84:*

These claims contain limitations similar to those in Claims 10 and 14, which were addressed in detail above; therefore, these claims are held obvious over the cited references with reasoning similar to that applied to Claims 10 and 14 above.

*Regarding Claims 46-49:*

These claims are similar to Claims 24-27, which were addressed in detail above; therefore, these claims are held obvious over the cited references with reasoning similar to that applied to Claims 24-27 above.

*Regarding Claims 50-54, 61, 65, 66:*

All limitations in these claims have been specifically address above in the various combinations of the cited references. Specifically regarding Claim 50: Note that Chang discloses (col. 1, lines 33-35) that photodiodes are generally used in imaging sensors in equipment such as PC cameras and digital cameras, wherein such equipment would include a processor. Therefore, these claims are held obvious over the cited references, since all limitations are disclosed, or rendered obvious, by the cited references.

*Regarding Claims 55-57:*

These claims contain limitations similar to those in Claims 5-7, which were addressed in detail above; therefore, these claims are held obvious over the cited references with reasoning similar to that applied to Claims 5-7 above.

*Regarding Claims 62, 63, 67-71, 78-83, and 85-87:*

All limitations in these claims have been specifically address above in the various combinations of the cited references. Specifically regarding Claim 67: Note that Chang discloses (col. 1, lines 33-35) that photodiodes are generally used in imaging sensors in equipment such as PC cameras and digital cameras, wherein such equipment would include an imaging device coupled to a processor. Therefore, these claims are held obvious over the cited references, since all limitations are disclosed, or rendered obvious, by the cited references.

*Regarding Claims 72-74:*

These claims contain limitations similar to those in Claims 5-7, which were addressed in detail above; therefore, these claims are held obvious over the cited references with reasoning similar to that applied to Claims 5-7 above.



***Allowable Subject Matter***

5. Claims 9, 20-23, 36, 59, and 76 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

6. The following is a statement of reasons for the indication of allowable subject matter:

Claims 9, 20-23, 36, 59, and 76 would be allowable primarily because claims 9, 36, 59, and 76 include a limitation requiring the doped region, located beneath the isolation region, to be spaced away from the edge of the isolation region, i.e., note in Figs. 2-9 and page 8 (lines 21-22) of the current disclosure, the doped region 140 is spaced away from the edge of the isolation region 120.

***Remarks***

7. Applicants' remarks/arguments have been carefully reviewed and considered, and in light of the remarks/arguments, all pending claims have been reconsidered and new grounds of rejection have been introduced. Accordingly, Applicant's remarks/arguments are moot in view of the new grounds of rejection.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lex Malsawma whose telephone number is 703-306-5986. The examiner can normally be reached on Monday through Thursday (1 PM - 9:30 PM EST).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 703-308-1323. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Lex Malsawma



November 30, 2003



MATTHEW SMITH  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800